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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project

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UNITED STATES DEPARTMENT OF AGRICULTURE  
Agricultural Research Administration  
Bureau of Entomology and Plant Quarantine  
Division of Domestic Plant Quarantines

1946 PROGRESS REPORT

of

GOLDEN NEMATODE CONTROL

The Division of Domestic Plant Quarantines  
Bureau of Entomology and Plant Quarantine

In Cooperation With

The Division of Nematology, Bureau of Plant  
Industry, Soils, and Agricultural Engineering;  
The New York State Department of Agriculture  
and Markets;

and

The Department of Plant Pathology,  
New York State College of Agriculture

Prepared by Harry L. Smith, Project Leader

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Hicksville, L. I., New York

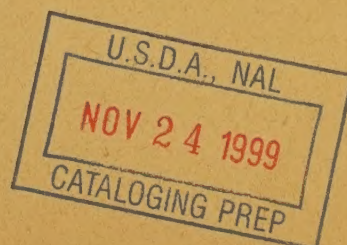






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## 1946 PROGRESS REPORT OF GOLDEN NEMATODE CONTROL

## SUMMARY

Surveys conducted during the summers of 1942-1945, inclusive, following discovery of the golden nematode of potato in a small area of Nassau County, New York, in 1941, disclosed the presence of this organism on approximately 1,081 acres of commercial potato producing lands in close proximity to the focal infestation. The affected area was placed under quarantine by the State of New York in 1944, and research investigations relating to biological, control, and regulatory phases of the problem were inaugurated.

The 1946 cooperative Federal-State program provided for an intensive survey of the quarantined area and nearby localities on Long Island and the application of one soil fumigation treatment on lands known to be infested at the close of the 1945 survey season. The accomplishment of these objectives was undertaken by the Bureau of Entomology and Plant Quarantine, in cooperation with the New York Department of Agriculture and Markets. Provisions were made for Bureau participation in research work on control investigations and commodity treatment methods in cooperation with the Division of Nematology, Bureau of Plant Industry, Soils, and Agricultural Engineering. Other phases of research in progress have been undertaken by the Department of Plant Pathology, New York State College of Agriculture, and the Division of Nematology. Field supervision of survey and control operations was delegated to the Division of Domestic Plant Quarantines, with temporary field office, survey, and control quarters established at Hicksville, New York. Additional facilities for identification work were provided at the Bureau laboratory located south of Hicksville.

Survey activities were conducted on 25,362 acres in Nassau and Suffolk Counties, New York, between May 16 and November 30, 1946. An intensive soil sampling method of survey was utilized on 10,006 acres, 8,989 of which were located within or adjacent to the quarantined area in Nassau County. The plant removal and root examination method of survey was employed on 15,356 acres, 10,100 of which were located in concentrated potato producing sections of Suffolk County. All soil samples and root specimens from the survey were processed and examined at the laboratory by a staff under the direction of a nematologist. Specimens tentatively identified as the golden nematode were referred to Dr. B. G. Chitwood, Division of Nematology, for confirmation. Reinspections were made to confirm all initial findings. Properties found infested for the first



time in 1946 numbered 47 and contained 1,595 acres. Nine of these properties, all of which are in Nassau County, were beyond the currently quarantined area. As of November 30, 1946, infestations of the golden nematode are known to exist on 81 properties, containing 2,677 acres, all in Nassau County, New York, in and near the original area of infestation.

With minor exceptions, lands found infested prior to 1946 were withheld from production and prepared for fumigation under land rental arrangements made by the New York Department of Agriculture and Markets. The fumigant D-D (dichloropropane-dichloropropylene), applicators, tractors, equipment, and personnel were provided by the Bureau of Entomology and Plant Quarantine. Five tractor-mounted applicators devised and constructed by Bureau personnel were utilized for the application of D-D at the recommended dosage rate of 450 pounds per acre. Following treatment, the land was rolled with agricultural rollers to obtain a permanent surface seal.

The fumigation of 1,104 acres of land found infested prior to 1946 was started on July 22 and completed by September 11. An additional 439 acres located in the southern section of the quarantined area and found infested for the first time in 1946 were fumigated between September 11 and October 31, following harvesting of the crops thereon and preparation of the soil. Heavy rains in July and August retarded control operations and caused erosion which necessitated the retreatment of portions of four fields totaling 14 acres. An aggregate of 1,557 acres were fumigated in 1946.

Cooperation was extended to the New York Department of Agriculture and Markets in the application of state quarantine regulatory measures. Arrangements made by this Bureau with that agency, the State of Pennsylvania's Bureau of Plant Industry, and the Production and Marketing Administration, U. S. Department of Agriculture, facilitated the safe disposal of 81 carlots of potatoes grown on infested land at distilleries in Pennsylvania where they were processed for alcohol.

Project activities were greatly facilitated by the splendid assistance rendered by the county agents of Nassau and Suffolk Counties, New York; officials of other cooperating agencies, and operators of the lands involved.



## 1946 PROGRESS REPORT OF GOLDEN NEMATODE CONTROL

### INTRODUCTION

The presence of the golden nematode of potatoes (Heterodera rostochiensis Woll.) in the United States was discovered in 1941 following investigation of decreased potato yields reported by a farmer at Hicksville, Nassau County, New York. Identification of the species was made by the Division of Nematology of the Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture. This organism, primarily a parasite of potato, has been recognized as responsible for reduced yields in the potato crops of the British Isles, Germany, Scandinavia, and the Baltic States for many years.

The nematode lives attached superficially to potato roots and tubers from which it extracts the juices thereby retarding plant growth and reducing crop yield. Following penetration of the root epidermis for feeding purposes, the posterior portion of the fertilized female larvae containing the egg mass extrudes outside the root surface. It develops into a white, lustrous, spherical-like protuberance which later changes in color to yellow or orange and subsequently to red or brown. The mature cysts are easily detached from potato roots or tubers and remain in the soil where they are difficult to detect. Cysts, or larvae therefrom, are readily disseminated by the movement of soil from infested fields and by natural means such as water flow. This nematode is not an internal parasite of potatoes and its known ability to survive in the soil for periods ranging up to eight years in the absence of its primary host makes control by crop rotation most difficult. Nematode population increases will occur in lands planted to potatoes for successive years without rotation, and progressive reductions in crop yields may be expected.

Following determination that the organism was present in Nassau County, surveys in the general environs of the known infestation were conducted by the New York Department of Agriculture and Markets in cooperation with the Division of Nematology. These surveys made during the summers of 1942, 1943, and 1944 disclosed additional infested potato fields in close proximity to the initial infestation. Survey of concentrated potato-producing areas in 19 northern states east of and including the Red River Valley in North Dakota and Minnesota was also made in 1944 by the Division of Domestic Plant Quarantines, Bureau of Entomology and Plant Quarantine, in cooperation with the Division of Nematology and the states concerned. No evidence of distribution of the golden nematode was found on this survey. In 1945 an intensive survey of potato fields located outside the known infested area in Nassau County and in concentrated potato-growing areas of Suffolk and Steuben Counties, New York was undertaken by this Bureau in cooperation with the Division of Nematology and New York State Department of Agriculture and Markets. Although no evidence of infestation was found in Suffolk or Steuben Counties, five new locations were found infested in Nassau County. Two of these locations were adjacent to previously known infested lands south of Hicksville, whereas the remainder was north and northeast of that community's business section in a region devoted largely to potato



production. At the end of the 1945 season, a total of 1,081.52 acres located in the vicinity of Hicksville, Nassau County, New York was considered infested.

For the purpose of preventing further spread of the golden nematode, the State of New York in March 1944, placed a quarantine on a designated area including all known infested and exposed lands. Regulatory measures were provided to restrict the movement of soil, seed potatoes, root crops, implements, farm machinery, containers, and other media of possible infestation dissemination. Reasonable provisions were afforded for direct disposition of the affected edible crops in the metropolitan area of New York City. The enforcement of this quarantine is a function handled by the New York Department of Agriculture and Markets.

Numerous research investigations relating to biological, survey, regulatory, and control phases of the problem have been undertaken by the Division of Nematology, and the Department of Plant Pathology, New York State College of Agriculture, in cooperation with the New York Department of Agriculture and Markets, and this Bureau. Host range, cover crop, commodity fumigation or treatment methods, and other revelant studies are in progress. Extensive field fumigation experiments conducted in 1944 and 1945 indicated the practicability of treatment of infested lands with the chemical D-D (dichloropropane-dichloropropylene), as a means of reducing populations of the golden nematode. Suitable mechanized applicators were developed to facilitate the large-scale fumigation of lands at reasonable costs.

Following conferences held in the spring of 1946 with operators of infested lands, H. H. Campbell, County Agricultural Agent of Nassau County, H. J. Simonson, Chairman of the Farm Bureau Executive Committee, and representatives of the cooperating government agencies, arrangements were made by this Bureau for active participation in the 1946 work program to the extent of accomplishing the following objectives:

- A. Conduction of a thorough survey in Nassau County, New York on lands in the regulated areas not known to be infested, lands outside the regulated area known to be exposed to infestation, and other areas on Long Island.
- B. Application of one soil fumigation treatment on infested lands taken out of production in the spring of 1946, and prepared by the State of New York for such fumigation; the chemical D-D, other necessary materials, equipment, and labor to be furnished by the Bureau for operations commencing in July.

In the establishment of the organization required to attain these objectives, arrangements were completed in the spring for the preparation and transfer of specialized mechanical equipment, vehicles, machines, furniture, laboratory equipment, and supplies to the project work sites at Hicksville. Many of these essentials were procured from various Divisions and projects of the Bureau who also assisted by the temporary transfer of



experienced field, mechanical, and office personnel. Temporary field office and survey vehicle-storage quarters were obtained outside the known areas of infestation, and temporary quarters for the maintenance and storage of control equipment were established within the infested territory. Additional work space and facilities for identification procedures were provided at the field laboratory located south of Hicksville.

Field activities were started in May with the inauguration of survey and laboratory identification work. The plan to start field control operations in July was effected.

### SURVEY

Survey activities for 1946 were initiated on May 16, at a time when potato plants were just breaking through the ground and continued until November 30, when cold and inclement weather prevented further efficient operation. Personnel to be engaged in the survey reported to Hicksville on May 14, and after two days of intensive instruction, three two-man crews commenced inspection in the field. By the end of the month four crews, consisting of nine inspectors, were in operation. Later, seven crews, with a personnel of 15 inspectors, were engaged on survey.

Early in the season, activities were confined to soil sampling methods. On July 16 a plant survey was initiated which lasted for seven weeks and at the conclusion of this phase of the survey efforts again were directed to soil sampling.

In the early phase of soil sampling, the survey was restricted primarily to the quarantined area in Nassau County, with priority being given to known boundary and operationally exposed fields, some of which were located outside the regulated area. By June 21, this work had been accomplished and the inspectors centered their efforts on the remaining fields located within the quarantined area. Upon completion of work within the regulated area, soil sampling activities were systematically extended in Nassau County east to the Suffolk County line, west of Hicksville to the Wantagh Parkway, and north to the Jericho Turnpike. The region north of the Jericho Turnpike is occupied by estates. Inspections were made on a number of estates having fields devoted to the growth of potatoes during the war years. In the locality to the south, between the quarantined area and the Southern State Parkway where there are no extensive potato plantings, a few small potato fields and numerous fields devoted to the growth of truck crops were surveyed. By the middle of July, the survey had established a number of newly infested properties, thus opening up additional operationally exposed locations outside the quarantined area and the survey was therefore extended outside the area, including the western part of Suffolk County. In addition, a limited amount of survey by soil sampling and an extensive amount by plant removal and root inspection was done in eastern Suffolk County. Special attention was given to the sampling of soil around barnyards, storage and grading sheds, and cull potato dumps; altogether, inspections of this type were made on 150 properties.



The soil sampling method of inspection resulted in the finding of golden nematode infestations on 44 properties, containing 1552.51 acres. Plant root inspections resulted in the finding of new infestations aggregating 42.63 acres on three properties. Of these new finds, nine locations are outside the present quarantined area. Six newly infested fields are just north of the boundaries on the north and northwest and three are southeast of the easterly side of the area. On the southwestern border, two newly infested fields are adjacent to, but inside the quarantine line.

#### Methods of Inspection

Soil Survey.--Inspectors assigned to soil survey were divided into crews consisting of two men, one of whom was designated crew leader. Each crew was provided with a small pickup truck for transportation, a map of the area to be surveyed, property ownership lists, a small pointing trowel, and a supply of heavy paper bags and essential forms.

Crews were usually assigned to survey entire districts. It was not necessary for them to contact property operators, inasmuch as persons concerned were informed of the program in advance of survey activities by the County Agents of Nassau and Suffolk Counties. Upon arrival at premises subject to inspection, the crew leaders looked over the land and subsequent to determining the property boundaries, size and shape, divided it into blocks to facilitate sampling in a manner assuring complete coverage. Forms containing an outline of the field and the estimated size and shape of blocks or units established for systematic soil sampling were prepared for guidance and as a permanent survey record.

Paper bags in which to place soil collections were prepared prior to the start of sampling in each block or unit to be surveyed. A collection number assigned systematically to each collection of samples on every property, the property identification number as recorded on maps and property lists, the field block or unit sample number, and the collection date were noted on the bags. A small pointing trowel was utilized for collection of the soil.

Fields planted to potatoes and other crops were sampled either lengthwise with the rows or across the rows in a staggered grid pattern, progress in a given direction being dependent upon crop or weed growth and other factors. Starting at the edge of the field about one-half to one ounce of soil was collected with a trowel from the top of the potato ridge and a like amount was taken from the furrow. The inspector then proceeded forward and repeated the process every eight paces until he reached the end of a designated block where he moved eight paces across the field and continued sampling parallel to his original course. This procedure, referred to as the 8 x 8 pace method, was continued until sampling of the entire field was completed. In lands adjacent to known infestations or otherwise susceptible to infestation to a greater degree where a more intensive sampling was deemed advisable, soil collections were made every 4 paces and, in some instances, every 2 paces. It was determined that the average soil sample taken with the standard 8 x 8 pace method represented collections from about 100 points per acre in the field and weighed from 4 to 6 pounds per two-acre sample.



As a matter of policy, reinspections were made to confirm all initial findings of infestation. By reference to the diagrams on reports prepared on the initial survey of each property, it was possible for inspectors to return directly to the block in which infestation had been located. For reinspection purposes this particular portion of the field was divided into smaller plots and intensively inspected by the 4 x 4 (400 points in field) or 2 x 2 (1600 points in field) pace method. It was determined that the division of properties into blocks and the subdivision of blocks into smaller plots, as well as the recording of diagrams on report forms, facilitated reinspection operations considerably.

Plant Root Inspection.--Potato plant growth and the development of nematode cysts on the roots of such plants had progressed to the point where it was feasible to start root inspection on July 16. Following training, most of the inspection personnel was assigned to this phase of survey for a seven week period ending August 31, when maturity of the crop precluded further efficient use of this method.

Plant root inspection surveys were conducted in Suffolk and Nassau Counties, New York, where acreages inspected exceeded 10,000 and 5,000 acres, respectively. Inspections were made at random locations in and around extensive potato plantings with especial attention being given to low spots in fields, areas around graders, loading platforms, and cull piles.

Plant roots immediately upon removal were examined with a hand lens for suspicious cysts. Specimens of golden nematode cysts or those of a questionable nature, found adhering to plant roots were preserved in vials and submitted to the laboratory for determination.

In addition to affording a rapid means of covering extensive potato plantings, this type of survey also provided a manner of confirming the presence of infestation on properties where golden nematode cysts had been collected in soil sampling. The two methods complement each other and both may be utilized advantageously; however, the plant root method is limited to the period when potato plants are in an active state of growth whereas the soil sampling method may be used for several months of the year.

#### Laboratory and Identification

All soil samples and specimens collected on plant root inspections were examined and identified at the Bureau laboratory located south of Hicksville within the infested area. Following completion of a work room, wash shed, and other facilities, operations were started at this site in May under the direction of Mr. John H. Machmer, Junior Nematologist, assigned temporarily to this project by the Division of Nematology, Bureau of Plant Industry, Soils, and Agricultural Engineering. Following training in the technique to be employed, three to seven employees were engaged throughout the survey season on soil washing and identification operations.

Identification work involved the washing of soil samples collected in the field and the examination under microscope of the residue and flotsam collected from such samples. The washing process devised to segregate



a light residue subject to examination for the presence of nematode cysts was accomplished by placing an individual sample in a large bucket which was partially filled with water and roiled. The water and flotsam were then poured off into two other buckets successively and roiled vigorously until the entire sample had been thoroughly washed. The water and flotsam were then passed through a series of sieves, the first of which retained the debris, and the last of which collected the nematodes. This residue was placed in a beaker bearing accurate sample identification markings. Subsequently, the contents of the beaker was placed in Syracuse dishes for preliminary examination under the binocular. These preliminary examinations were made by examiners and all suspicious specimens were removed and referred to Mr. Machmer for slide preparation and microscopic study. Positive findings were then submitted to Dr. B. G. Chitwood, Nematologist, Bureau of Plant Industry, Soils, and Agricultural Engineering, for final identification confirmation. The laboratory identification unit reported all positive determinations to the project office. Subsequent to the second or confirmation sampling and determination, notification relating to the infestation was given to the New York Department of Agriculture and Markets.

As of November 30, when field survey activities were discontinued for the season, the laboratory unit had processed 5,016 samples, representative of collections from 9,000 acres. Soil samples remaining on hand will be processed by December 20.

#### Sanitary Measures

In consideration of the characteristics of the organism and potentialities of dissemination, every reasonable precaution and sanitary practice was applied in field operations.

Vehicles assigned to survey activities were not permitted to operate on infested lands or properties subject to inspection. They were stored in a garage located outside the general area of infestation, washed periodically, and steam-cleaned prior to movement from the quarantined area.

Inspectors engaged on survey cleaned their shoes with brushes upon entering and departing from properties where inspections were conducted. Trowels in use were free from soil-collecting grooves and recesses and were cleaned following sampling of each property. All soil collections were transported in closed bags or containers following collection and soil was not carried from one property to another. All such collections were systematically marked and recorded to prevent loss of identity. Samples were checked into the laboratory where identification was maintained throughout processing by markings on containers and by log records. Containers and vessels used in the washing and examination of samples were washed thoroughly after each operation and every precaution taken to absolutely preclude contamination.



Table No. I

Soil Survey in Nassau and Suffolk Counties, New York - 1946

County	: Acres : Surveyed	: Properties : Found Infested	: Acres in : Infested Properties
Nassau	8,989	44	1,552.51
Suffolk	1,017	0	0
Total	10,006	44	1,552.51

Table No. II

Plant Root Survey in Nassau and Suffolk Counties, New York - 1946

County	: Acres : Surveyed	: Properties : Found Infested	: Acres in : Infested : Properties	: No. of : Plant Roots : Inspected
Nassau	5,256	3	42.63	42,536
Suffolk	10,100	0	0	30,581
Total	15,356	3	42.63	73,117

Table No. III

Summary of Soil and Plant Root Surveys in Nassau and Suffolk Counties, New York  
1946

County	: Acres : Surveyed	: Properties : Found Infested	: Acres in : Infested Properties
Nassau	14,245	47	1,595.14
Suffolk	11,117	0	0
Total	25,362	47	1,595.14

NOTE: All figures as of November 30, 1946.



Table No. IV

Laboratory Identification of Samples - Golden Nematode Survey 1946

(Data as of November 30, 1946)

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Soil Samples Collected.....	5,535
Samples Processed.....	5,016
Samples Remaining to be Processed.....	519
Properties Determined Infested.....	47
Acres in Infested Properties.....	1,595

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Present Status of Golden Nematode Infestation

The following tables present a summary of properties found infested with golden nematode prior to 1946, and those found infested in 1946. At the present time, 81 infested properties are known comprising 2,677 acres.



Table No. V

Properties Found Infested With Golden Nematode Prior to 1946

Property Number	Operator	Acres
<u>1941 (2 Properties)</u>		
46-T-1	Charles Gellweiler	43
46-T-3	George Stiehler	73.50
<u>1942 (10 New Properties)</u>		
46-S-23A,B	Charles Gellweiler	42
46-S-46	Charles Gellweiler	15
	D. Rowehl	13.50
46-S-52	L. Skipka	30
46-S-53	Charles Gellweiler	20
46-S-82,26	Charles Gellweiler	28
46-S-85	D. Rowehl	31.80
46-T-1 (initial report 1941)	Joseph Walsh	20.96
46-T-2	Charles Gellweiler	29.90
51-C-1	Hohorst Bros.,	50
	George Stiehler	38
	John Seligman and	32.40
	C. & W. F. Rowehl	15
<u>1943 (9 New Properties)</u>		
46-M-1	Charles Gellweiler	24.30
46-M-2	Charles Gellweiler	24.40
46-S-45	D. Rowehl	27.70
46-S-54	Charles Gellweiler	26.37
46-S-81B	Charles Gellweiler	6.50
51-C-4	John Seligman	122.50
51-C-12	John Seligman	63.50
51-C-106,108	C. & W. F. Rowehl	70.50
<u>1944 (5 New Properties)</u>		
46-S-45 (initial report 1943)	John Seligman	27.60
46-S-81A	Charles Gellweiler	19.32
46-S-84,90,91	D. Rowehl	66.50
51-C-1 (initial report 1942)	C. & W. F. Rowehl	6.50
51-D-12	C. & W. F. Rowehl	5.00

(Table No. V continued next page)



Table No. V (Continued)

Properties Found Infested With Golden Nematode Prior to 1946

Property Number	Operator	Acres
<u>1945 (8 New Properties)</u>		
12-D-39,61	Schneider Bros.	25.89
12-J-14	E. Harbes	43
12-L-1,2	William Duffy	19.38
12-28 to 33	J. Krewack	13
46-Q-1,2	John Wojtyniak	6.50
Total Properties... 34		Total Acreage..... 1,081.52



Table No. VI

Properties Determined Infested - Golden Nematode Survey 1946

Property Number	Operator	Acres
12-B-1000	L. Wesnofske	20.00
12-D-100, 103 & 90	L. Wesnofske	40.00
12-E-1	S. & E. Meyer	35.00
12-E-2	S. & E. Meyer	10.00
12-E-3	J. Froelich, Jr.	21.37
12-E-4	Bergold Bros.	91.48
12-E-207	L. Finn	26.56
12-F-38 & 37	L. Finn	92.41
12-F-39B	J. Wicks	53.50
12-H-102	J. Froelich, Jr.,	134.50
12-J-2	L. Finn	33.00
12-J-6	Margot Bros.	23.00
12-J-13	E. Harbes	20.00
13-A-26	J. Froelich, Jr.,	95.00
15-D-8, 9, 21 (3 properties)	J. Froelich, Jr.,	125.00
15-D-10	J. Kennedy	30.70
45-L-13	F. Bartel	50.00
45-L-14	M. Dwyer and Sons	110.50
45-L-17	Rowehl Bros.	43.00
45-M-2, 4 & 8 (3 properties)	J. Seligman	100.00
46-K-37	J. Walsh	28.00
46-L-2B	G. Bergold & Sons	26.41
46-M-3	G. Bergold & Sons	20.00
46-S-21 & 22 (2 properties)	Rowehl Bros.	33.33
46-S-27	W. Schoppman	8.00
46-S-48	P. DeLalio	37.00
46-S-50	J. Wojtyniak	43.00
46-S-80	F. Hartmaier	15.00
46-V-2 & 194	C. Gellweiler	12.00
47-G-10	Gerhard Bros.	16.00
49-G-18	E. D. Moore	45.00
51-D-2	J. Swierupski	37.25
51-D-3-4-6	F. Ludwig	10.63
51-D-5	O. Streeseman	18.00
51-D-8	S. Catts	2.50
51-D-9	C. Gellweiler	14.00
51-D-10	O. Streeseman	28.00
51-D-107 & 207	J. Retzler	4.00
52-A-14	F. Ludwig	32.00
52-A-22 & 123 (2 properties)	F. Ludwig	10.00

Total Properties..... 47

Total Acres..... 1,595.14



Table No. VII

Summary of Properties Infested With Golden Nematode ---- 1941 - 1946

Year	No. of Properties	No. of Acres
1941	2	116.50
1942	10	366.56
1943	9	365.77
1944	5	124.92
1945	8	107.77
1946	<u>47</u>	<u>1,595.14</u>
Totals	81	2,676.66



## CONTROL

### Equipment, Materials, and Procedures

Preparatory to the application of control measures, Bureau-owned tractors, trucks, mechanical attachments of special design, maintenance equipment and tools, and carlots of soil fumigant (D-D) were shipped to Hicksville. A work shop located on infested property in the southerly part of the quarantined area was leased as an operational center. Two additional privately-owned tractors and five cultivator attachments were rented from local farmers. Three agricultural rollers were loaned to the project by the Long Island State Parkway Commission. Upon completion of assembly, five tractor-mounted applicators were available for application of the fumigant, three tractor-drawn rollers were available for sealing of the soil surface after treatment, and five trucks were at hand for use as supply units. Several seasonal employees engaged to assist experienced mechanics temporarily assigned from other Bureau projects provided a personnel of twelve workers for control operations.

Research findings of the Division of Nematology resultant from field experiments conducted during the two previous years indicated the practicability of accomplishing a high degree of control of the golden nematode with D-D (dichloropropane-dichloropropylene) applied with mechanical applicators at the dosage rate of 450 pounds per acre. All control applications in 1946 were made at this rate. D-D used during the season totaled 798,399 pounds.

All mechanical applicators were mounted on Oliver "70" row crop tractors. The liquid fumigant D-D was carried in two 55-gallon steel tanks mounted forward on both sides of the tractor motor above the cultivator booms. It was pumped from those tanks by a Hardie pump mounted on the rear of each tractor directly behind and below the operator's seat. Power to operate the pump, also utilized to refill the tanks with D-D, was obtained direct from the rear power take-off. Standard elevator-type cultivator attachments with six cultivator shoes of special design were mounted in line at 12-inch spacings behind the tractor front wheels. A spray nozzle of special design was attached to the rear of each cultivator shoe with a metal holder. The stationary nozzle, well protected by the shoe and metal holder, permitted only a downward discharge of the D-D in a solid stream at the four to six-inch level when lowered in friable soil. All applicators were calibrated to discharge 450 pounds of D-D per acre at designated speeds and dosages were checked frequently during field operations. Variations in output due to soil clogging the nozzles or other causes could readily be detected by the use of a pressure gauge mounted in full view of the operator. The fumigant reached the nozzles through short lengths of flexible hose extending from a spray boom mounted immediately above the cultivator attachments. Shortly after operations were started it was found necessary, due to the solvent effect of D-D on rubber hose, to replace it with special hose connections lined with "Resistoflex". Subsequently, pump diaphragms, gaskets, and washers were replaced with this product. A rapid means of leveling and temporarily sealing the soil surface immediately after application of the fumigant was provided by a metal bar-drag located about twelve inches behind the cultivator shoes. It was determined that each of the five applicators



in operation could cover in excess of twelve acres during the normal work day. Tractor-applicators operated in the directions in which fields are normally worked by the farmers. Blocks in each field were established and worked out completely by individual tractor-applicators to assure complete coverage.

Agricultural rollers were utilized for the purpose of obtaining a permanent soil surface seal, thus confining the fumigant therein. At the beginning of operations two sectional rollers, approximately six feet in width, were used. Subsequently, three of these rollers were placed in operation, one as a single unit, and two in tandem. In order to expedite rolling operations, two rollers approximately eleven feet in length were built by the project as replacements for the rollers affording only a six-foot swath. All rollers were tractor-drawn, two Bureau-owned Farmall Model H tractors being utilized for this purpose. Every effort was made to accomplish the rolling of treated lands immediately after application of the fumigant. Usually rollers followed the course and pattern set by the tractor-applicators, but in some instances rough terrain made a second cross-rolling advisable. It is proposed to leave the fumigated land undisturbed until the spring of 1947.

Trucks were utilized for the removal of carload shipments of D-D, placement of materials and equipment in fields to be treated, as gasoline supply units for tractors, and for the transportation of supplies and personnel. Vehicles assigned to control operations were not used in other phases of project operations and were confined exclusively to movement within the regulated area. All vehicles and equipment were cleaned prior to movement through non-infested sections of the quarantined area.

The New York Department of Agriculture and Markets handled all arrangements for withholding from production, plowing and otherwise preparing infested lands subject to fumigation. Their efforts in this respect were supplemented by excellent assistance and cooperation from County Agent Campbell, Nassau County Officials, and operators of the lands involved. Under the approved work program, the fumigation of 1,056.16 acres of infested lands removed from production was undertaken by this project.

#### Application of Fumigant

The equipment for the application of D-D was constructed and assembled, and the field fumigation carried out by Mr. Richard A. Tate, assisted by Mr. William J. Dunn. The initial application of control measures was made on July 22 in the main portion of the southern infested section (property No. 46-S-52). Operations were continued in that sector until all fields known to be infested at the beginning of the 1946 survey season, or portions thereof, that had been taken out of production were treated. Operations were then extended to the fields in that category north and northeast of the Hicksville business district. The fumigation of all fields found infested prior to 1946, which had been properly prepared for treatment, was completed by September 11.



Control activities were curtailed but continued after that date to provide for the fumigation of a number of properties located in the southern section that had been found infested during the current survey season, as well as fields or portions thereof not prepared for treatment at the designated time and the retreatment of parts of fields affected by heavy rains following initial applications. Delays were encountered in the treatment of fields found infested in 1946 due to the need for harvesting the current year's crop and subsequent preparation of the land. However, of the twenty newly infested fields in the southern section considered for treatment, applications were made on thirteen in their entirety and on all but small portions of three others. The untreated portions were planted to late maturing **truck** crops, as were the greater portions of the four remaining fields that were not treated. Also, one operationally and border-exposed field (45-L-28) was treated. Infestation was found late in the season on this property and rather than defer treatment until time permitted the taking and determination of confirmation samples, it was deemed advisable to apply control measures. Treatment this year of the new infestations found in the northern section was not considered feasible because of the rapidly increasing expansion of infested lands in that sector as well as time limitations. All control activities were concluded October 31. By that date treatments of D-D fumigant had been applied to 1,104.33 acres of lands found infested prior to 1946, 438.77 acres located in the southern section, as determined infested for the first time in 1946, and 14 estimated acres on which second applications were made in consideration of washouts and erosion following heavy rains subsequent to initial treatments. Consequently, land fumigated with D-D during the 1946 control season, between July 22 and October 31, aggregated 1,557.10 acres.

Control operations were hampered considerably during July and August by periodic heavy rains following which the saturated condition of the soil necessitated deferment of field work for periods varying from one to four days. Torrential rains on August 7 were responsible for unprecedented sheet and gully erosion in several fields containing sloping contours which had been treated shortly before that date. This necessitated the retreatment of portions of four fields totaling 14 acres. As an erosion preventive measure, the planting of winter rye as a cover crop was tried with success in a few instances both before and subsequent to application of the fumigant. The taking of such measures on a large scale was not necessary, however, in view of the near normal post-fumigation growth attained by weeds and other native vegetation. Delays in the work program as a result of frequent rains were offset by the performance of overtime work, permitting a twelve-hour operational period authorized between August 2 and September 7.

The fumigant was applied mostly during the months of August, September, and October when the monthly mean soil temperatures were 69°, 66°, and 57° F., respectively, while the monthly mean air temperatures were 72°, 68°, and 60° F., respectively. Daily records of both soil and atmospheric temperatures were kept and are available for further study in relation to the fumigation work.



Comfortable atmospheric temperatures prevailed during the control season. No indications of temperature effects in relation to D-D application upon the operators were evident. The perceptible, unpleasant odor of D-D, especially on still mornings when fog confined vapors to low levels, was somewhat annoying. The use of mechanical means to transfer D-D from drums to tanks on the tractor-applicators minimized the possibilities of control workers inhaling or otherwise being seriously affected by the chemical. Respirators and goggles were available for the operators but their use was not found essential. Following completion of its use on control operations, all equipment was thoroughly cleaned and prepared for winter storage. Rented equipment was returned to its owners by November 1, and the storage of Bureau-owned equipment and supplies at the project control work shop was completed by November 15.

Table No. VIII

Properties Fumigated - Golden Nematode Control Season 1946.

Determined Infested Prior to 1946

Property No.	Acres Treated	Acres Retreated	Treatment Date
<u>Northern Section</u>			
12-D-39 & 61	27		9/7/46
12-28 to 33	13		9/23/46
12-J-14	44		9/7/46
12-L-1 & 2	22.48		9/10/46
46-Q-1	3		9/11/46
46-Q-2	4		9/11/46
Total Acres	113.48		
<u>Southern Section</u>			
46-S-81A, B	25		7/29/46
46-S-54	26.37		7/29/46
46-S-52	30.67		7/25/46
46-S-53	20		7/30/46
46-S-85	31.80		8/1/46
46-S-46	29.50		8/1/46
46-S-23A, B	44		8/2/46
46-S-82	18		8/5/46
46-S-26	10		8/5/46
46-S-90	28	2	8/3/46 & 9/26/46
46-S-91	8	2	8/3/46 & 9/23/46
46-S-84	30	8	8/2/46 & 9/23, 26/46
46-S-45	57		8/14/46
46-T-1	57.50		8/16/46 & 10/11/46
46-T-2	32		8/13/46
46-T-3	70.80		8/21/46
46-M-1	22.71		8/22/46
46-M-2	23		8/22/46
51-C-1	159		8/28/46
51-C-106	29	2	9/2/46 & 10/3/46
51-C-108	46.50		9/5/46
51-C-4	122		8/25/46
51-C-12	65		8/25/46
51-D-12	5		10/2/46
Total Acres	990.85		



Table No. IX

Properties Fumigated - Golden Nematode Control Season 1946

Determined Infested During 1946

Property No.	Acres Treated	Acres Retreated	Treatment Date
<u>Southern Section</u>			
51-D-2	31		10/22/46
51-D-3,4,6	7.66		10/2/46
51-D-107, 207	3.30		10/30/46
51-D-8	3.30		10/31/46
51-D-9	12		10/4/46
51-D-5	15		10/28/46
51-D-10	21.50		10/23 & 10/30/46
46-V-2, 194	9.25		9/18 & 10/11/46
46-S-48	33		10/4/46
46-S-50	40		10/23 & 10/24/46
46-S-80	15		9/10/46
46-S-21	14		9/16/46
46-S-22	18.93		9/16/46
45-L-13	51.50		10/4/46
45-L-14	99		10/14/46
45-L-17	42.33		9/6/46
45-L-28	22		9/17/46
Total Acres	438.77		

Table No. X

Summary of Properties and Acreage Fumigated - 1946

Properties Determined Infested Prior to 1946	No. of Locations	Total Number Acres Treated	Total No. Acres Retreated
Northern Section	6	113.48	
Southern Section	24	990.85	14
<hr/>			
Properties Determined Infested on the 1946 Survey			
Southern Section	17	438.77	
	<hr/>	<hr/>	<hr/>
	47	1,543.10	14
<hr/>			
Aggregate Acres Treated in 1946.....		1,557.10	



### REGULATORY

The State of New York's quarantine designed to prevent spread of the golden nematode was revised effective February 15, 1946, in order to include the additional properties found infested during the 1945 survey and adjacent territory. Quarantine requirements prohibit the movement from regulated areas of potatoes for seed purposes and topsoil removed from infested or exposed lands. Restrictions are placed on the movement of topsoil from other lands under quarantine to nonregulated areas and on the movement to such destinations of used farm machinery or equipment, used bags or other containers, and table stock potatoes or root crops from designated infested or exposed lands. Provisions have been made for the authorized movement of potatoes or root crops free from excessive soil directly to New York City for consumption or prompt processing, as well as to other processing plants under prescribed conditions.

A difficult marketing problem relating to safe disposition of the potato crop grown on infested lands developed as a result of the unusually large acreage planted to potatoes in 1946, the excellent yield obtained, and the finding of an appreciable number of newly infested properties. Growers found an outlet through the Production/Marketing Administration, U. S. Department of Agriculture, for the movement of many carloads of potatoes to distillery plants where they were utilized for alcohol production. Arrangements completed with that agency permitted the movement of more than four million pounds of potatoes from infested or exposed fields to two distilleries in the State of Pennsylvania with the consent of the Bureau of Plant Industry of that State. Shipments moved in carlots under limited permits following the taking of precautionary measures which precluded diversion of the cars and provided for sealing of car doors at shipping points to insure that soil and tubers did not escape in transit. Provisions were made at the distilleries for adequate car cleaning and the treatment or proper disposal of sacks under the supervision of Bureau inspectors. Of the 81 carlots processed under these arrangements, 36 cars and the sacks used as containers for the contents thereof were sterilized with live steam following unloading of the potatoes at Schenley, Pennsylvania. At the second distillery, located in Philadelphia, Pennsylvania, 45 cars were flushed with water under high pressure and thoroughly disinfected with a 3 percent ammonium hydroxide solution.

During most of October and November, one Bureau inspector was assigned to the New York Department of Agriculture and Markets to assist that agency in their field quarantine activities. Through field observations, analysis of regulatory problems, development of an improved system of record maintenance, and periodic progress reports, efforts were made to assist in the formulation and application of uniform quarantine operational procedures.

Project regulatory activities otherwise were limited to the furnishing of information that might be of assistance to cooperating agencies in checking the disposition of numerous potato shipments made from the quarantined area to New York City and other destinations.

WEATHER RECORDS - CONTROL SEASON, 1946  
Hicksville, L. I., New York

July	Air Temperatures °F.			Precipitation Inches
	Maximum	Minimum	Mean	
1	81	69	75	
2	84	67	75.5	2.32
3	79	63	71	
4	83	60	71.5	
5	82	60	71	
6	81	67	74	0.04
7	92	71	81.5	
8	75	66	70.5	
9	77	68	72.5	
10	85	70	77.5	
11	71	65	68	
12	78	68	73	
13	87	68	77.5	
14	87	62	74.5	
15	70	68	69	
16	75	56	65.5	
17	81	55	68	
18	90	58	74	
19	88	67	77.5	
20	91	72	81.5	0.05
21	84	68	76	0.48
22	81	68	74.5	0.39
23	74	67	70.5	0.94
24	78	67	72.5	
25	80	69	74.5	
26	81	65	73	
27	83	62	72.5	
28	84	60	72	
29	86	61	73.5	
30	87	65	76	
31	83	64	73.5	

Mean Maximum 81.6

Absolute Maximum 92

Mean Minimum 65

Absolute Minimum 55

Mean Mean 73.3

Total Rainfall Inches 4.22



WEATHER RECORDS - CONTROL SEASON, 1946

Hicksville, L. I., New York

August	Air Temperatures °F.			Soil Temperatures °F.			Precipitation Inches
	Maximum	Minimum	Mean	High	Low	Mean	
1	70	61	65.5				0.08
2	76	60	68				1.78
3	80	61	70.5				.19
4	84	65	74.5				1.35
5	87	69	78				1.42
6	86	66	76				
7	70	64	67				
8	83	61	72				
9	83	65	74				
10	79	71	75				
11	80	64	72				
12	80	60	70				0.19
13	71	62	66.5				
14	72	61	66.5				
15	76	58	67	70	70	70	0.16
16	78	64	71	70	70	70	0.17
17	90	69	79.5	78	72	75	
18	79	69	74	78	76	77	
19	70	64	67	68	66	67	
20	81	65	73	70	68	69	
21	80	60	70	70	67	68.5	
22	80	65	72.5	70	68	69	0.21
23	72	63	67.5	70	67	68.5	0.46
24	75	58	66.5	69	66	67.5	
25	78	56	67	69	65	67	
26	75	59	67	68	66	67	0.43
27	76	58	72	68	66	67	.01
28	82	57	69.5	68	65	66.5	.02
29	79	67	73	70	68	69	.54
30	68	55	61.5	68	64	66	
31	74	55	64.5	68	62	65	

Air Temperature °F.

Mean Maximum 82  
Absolute Maximum 90

Mean Minimum 62  
Absolute Minimum 55

Mean Mean 72

Total Rainfall Inches 7.01

Soil Temperature °F.

Mean Maximum 70.11  
Absolute Maximum 70

Mean Minimum 67.23  
Absolute Minimum 76

Mean Mean 68.76

WEATHER RECORDS - CONTROL SEASON, 1946

Hicksville, L. I., New York

September	Air Temperatures °F			Soil Temperatures °F			Precipitation Inches
	Maximum	Minimum	Mean	High	Low	Mean	
1	82	55	68.5	67	57	62	
2	80	61	70.5	66	62	64	
3	72	57	64.5	68	64	66	
4	73	54	63.5	66	61	63.5	
5	72	60	66	64	62	63	
6	73	57	65	66	60	63	
7	81	62	71.5	69	64	66.5	
8	85	67	76	70	65	67.5	
9	75	67	72	68	66	67	
10	81	69	75	73	68	70.5	
11	80	62	72	72	69	70.5	
12	71	57	64	69	64	66.5	
13	65	53	59	64	60	62	
14	68	51	59.5	65	58	61.5	
15	75	53	64	66	58	62	
16	79	57	68	68	58	63	
17	85	59	72	70	61	65.5	
18	86	61	73.5	71	64	67.5	
19	89	60	74.5	72	64	68	
20	86	63	74.5	72	66	69	
21	71	62	66.5	68	66	67	0.50
22	81	64	72.5	72	66	69	
23	72	64	68	68	66	67	
24	73	66	69.5	69	67	68	1.02
25	80	63	71.5	74	68	71	
26	78	58	68	71	64	67.5	
27	83	56	69.5	70	63	66.5	
28	76	59	67.5	70	63	66.5	
29	69	59	64	70	62	66	0.21
30	69	47	58	64	60	62	1.52

Air Temperature °F

Mean Maximum 77

Absolute Maximum 89

Mean Minimum 59

Absolute Minimum 47

Mean Mean 68

Soil Temperature °F

Mean Maximum 68.7

Absolute Maximum 73

Mean Minimum 63.2

Absolute Minimum 57

Mean Mean 65.97

Total Rainfall Inches 3.25



WEATHER RECORDS - CONTROL SEASON, 1946

Hicksville, L. I., New York

October	Air Temperatures °F.			Soil Temperatures °F.			Precipitation Inches
	Maximum	Minimum	Mean	High	Low	Mean	
1	53	46	49.5	58	54	56	
2	57	43	50	57	52	54.5	
3	69	40	54.5	60	50	55	
4	76	49	62.5	64	54	59	
5	79	53	66	64	57	60.5	
6	85	53	69	66	57	61.5	
7	85	58	71.5	66	59	62.5	
8	67	47	57	63	60	61.5	
9	59	47	53	58	55	56.5	0.06
10	61	53	57	60	56	53	0.21
11	71	58	64.5	63	58	60.5	0.06
12	71	59	60	64	61	51.5	0.21
13	69	55	62	62	57	59.5	
14	62	48	55	59	52	55.5	
15	61	47	54	60	52	56	
16	66	48	57	58	52	55	
17	68	44	56	59	52	55.5	
18	68	53	60.5	59	56	57.5	0.11
19	65	55	60	60	54	57	
20	62	48	55	54	51	52.5	
21	61	45	53	56	49	52.5	
22	65	40	52.5	57	49	53	
23	68	42	55	56	50	53	
24	73	44	58.5	57	50	53.5	
25	70	49	59.5	59	52	55.5	
26	69	60	64.5	59	56	57.5	0.01
27	72	59	65.5	61	57	59	
28	78	56	67	62	58	60	
29	72	62	67	62	60	61	
30	81	60	70.5	64	60	62	
31	81	61	71	63	60	61.5	

Air Temperature °F.

Mean Maximum 69  
Absolute Maximum 85

Mean Minimum 51  
Absolute Minimum 40

Mean Mean 60

Total Rainfall Inches 0.66

Soil Temperature °F.

Mean Maximum 60.32  
Absolute Maximum 66

Mean Minimum 54.83  
Absolute Minimum 61

Mean Mean 57.38

WEATHER RECORDS - CONTROL SEASON, 1946

Hicksville, L. I., New York

November	Air Temperatures °F			Precipitation Inches
	Maximum	Minimum	Mean	
1	67	54	60.5	
2	63	57	60	
3	62	56	59	
4	70	57	63.5	
5	53	42	47.5	
6	56	42	49	
7	63	44	53.5	
8	65	51	58	
9	59	49	54	0.27
10	56	44	50	
11	66	52	59	0.08
12	60	52	56	
13	52	36	44	
14	57	38	47.5	
15	46	35	40.5	
16	55	32	43.5	
17	54	46	50	0.28
18	49	36	42.5	
19	51	37	44	
20	58	33	45.5	
21	60	40	50	
22	58	38	48	
23	39	32	35.5	
24	48	28	38	

Air Temperature °F.

Mean Maximum	57
Absolute Maximum	70
Mean Minimum	43
Absolute Minimum	28
Mean Mean	50
Total Rainfall Inches	0.63











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